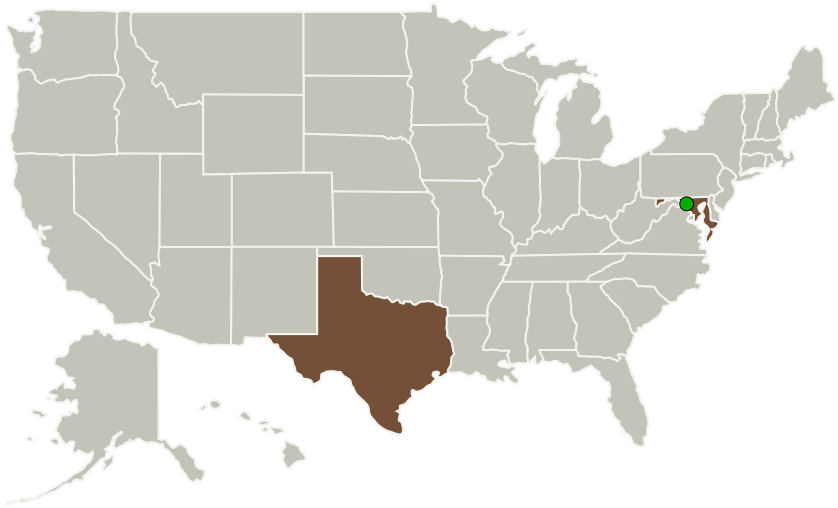
Diamond Turned Super Alloy Mandrel for Slump Forming X-Ray Observatory (IXO) Mirrors, Phase I

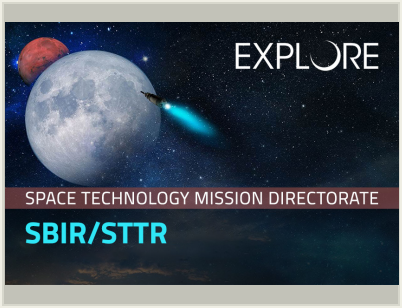
Completed Technology Project (2012 - 2012)

Project Introduction

Diamond turning is proven to be able to quickly produce highly aspheric grazing incidence optical contours to visible wavelength tolerances with extremely smooth surfaces. Super alloys with exceptional dimensional stability and strength under cyclic high temperatures have been developed for gas turbine engines. The thermal expansion can be in the range of the expansion of the borosilicate glasses used for X-Ray mirrors. This proposal utilizes an existing manufacturing learning curve to develop a reliable material and manufacturing process for glass slumping mandrels. This development process will involve the following investigations and development goals : -develop electroless nickel plating processes for super alloys, -ultra precision machining and polishability of super alloys. -diamond turning of electroless nickel before and after the slumping heat cycle. -heat treatment for dimensional stability under thermal cycling. -evaluation of oxidation of directly polished super alloys. -evaluation of oxidation of polished electroless nickel. Heat treatment and plating processes will be evaluated by producing a number of flat test mirror samples which will be measured optically before and after the glass slumping process to evaluate contour distortion, oxidation resistance, increase in surface roughness, and diamond machineability of the electroless nickel plating. A test slumping mandrel will be designed for fabrication in a Phase II SBIR.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
Dallas Optical Systems, Inc.	Lead Organization	Industry Veteran-Owned Small Business (VOSB)	Rockwall, Texas
Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations	
Maryland	Texas

Project Transitions

February 2012: Project Start

August 2012: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138098)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Dallas Optical Systems, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

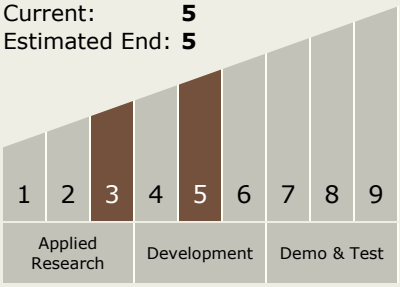
Carlos Torrez

Principal Investigator:

John M Casstevens

Technology Maturity (TRL)

Start: **3**
Current: **5**
Estimated End: **5**



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Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.2 Observatories
    - TX08.2.1 Mirror Systems

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System